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THE AMERICAN NATURALIST.

VOL. XVIII.—OCTOBER, 1884.—No. 10.

THE NORTH AMERICAN GEASTERS.

BY A. P. MORGAN.

THE Geasters are the most beautiful and attractive of the puff-balls, yet they seem not to be well understood. Most of them grow in woods about old stumps and rotten logs; others grow among the old leaves, and are found expanded on their surface; *G. minimus* grows in meadows and grassy lands.

They begin in a globose or ovoid form with a pointed apex; they make a slow growth just beneath the surface of the ground or under the leaves, often remaining closed for a long time; finally, with abundant rains in late summer or early autumn, they expand their segments and lift their puff-balls into the air. They dry up quickly and disappear with the clearing weather, so that specimens must be secured promptly after they have expanded. *G. limbatus*, however, with us is found very late in autumn and during the mild rainy weather in winter.

The species are more or less gregarious in habit, though some of them often occur singly. I have found more than twenty of the great *G. triplex* in one nest together. *G. saccatus* is found commonly scattered about upon the leaves, sometimes in great numbers; its mycelial threads run out over their surface from the little eggs.

Several of the species appear to be generally distributed, as *G. limbatus*, *minimus*, *fimbriatus*, *saccatus*, *hygrometricus*, and when the species are better known it is quite likely others will be found in every part of the country. *G. fornicatus*, *radicans*, *rufescens* are southern in their range. The beautiful *G. umbilicatus* has been found only in New Jersey by Mr. Ellis; it is No. 110, *G. mammosus* Chev., of the N. A. Fungi, but this is not possible

on account of the size of the spores, which in the latter are .009^{mm}. *G. bryantii* is reported from New York by Professor Peck. *G. fibrillosus* grows in Pennsylvania and Carolina. *G. linkii* does not appear to have been recorded since the time of the great de Schweinitz. *G. triplex* grows abundantly about Cincinnati, and Mr. Foerste found it near Detroit. *G. striatus*, *vittatus*, *lagenæformis* have been found only in the Miami valley, but the two latter appear to me to be only fairly marked forms of *G. sac-catus*, and will probably be found along with it elsewhere.

Our *G. limbatus* is the *G. multifidum* DC., of the Scottish cryptogamic flora and on the cover of *Grevillea*; but the *G. limbatus* of *Grevillea*, Vol. II, Plate XVII, must be something else. The wonderful *G. coliformis* Pers, with many pedicels and numerous mouths, has not yet been found in this country.

Geaster Mich., Earth Star.—Receptacle double, consisting of an outer and an inner peridium, growing separately and persistent. Outer peridium fleshy-coriaceous, thick, stellately divided into several segments; inner peridium papyraceous, dehiscing by a mouth at the apex; spores globose, brown, mostly echinulate.

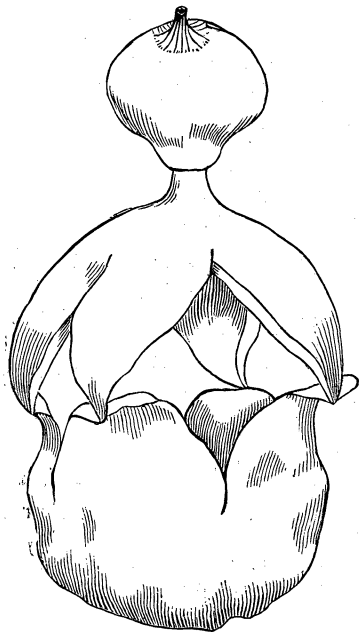


Fig. 1.

I. FORNICATI.

Outer peridium double, separating into an outer and an inner coat.

1. *G. fornicatus* Fr.—Inner coat vaulted, the segments reflexed; inner peridium pedicellate, the mouth conic-striate (Fig. 1).

The two coats of the outer peridium separate even to the tips of the segments; the outer coat remains firmly attached to the soil while the inner becomes vaulted over it by the bending backward of its segments; the inner peridium is thus uncovered and lifted on high upon its pedicel. Segments 4-5, rarely more; inner peridium subglobose or depressed, more or less contracted at the base; the mouth always prominent conic

cylindric, $\frac{1}{2}$ -1 inch in diameter; spores .0035-.0040^{mm}.

2. *G. radicans* B. & C.—Inner coat vaulted, the segments reflexed; inner peridium subpedicellate, the mouth ciliate, fimbriate.

The inner coat is lifted up and vaulted on the tips of the outer coat as in *G. fornicatus*. The outer peridium arises out of rooting fibers; inner peridium reddish, very shortly pedicellate, about $\frac{3}{4}$ of an inch in diameter; the mouth silky as in *G. fimbriatus*.

3. *G. triplex* Jungh.—Inner coat detached about the middle and forming a cup; inner peridium sessile, the mouth ciliate-fimbriate (Fig. 2).

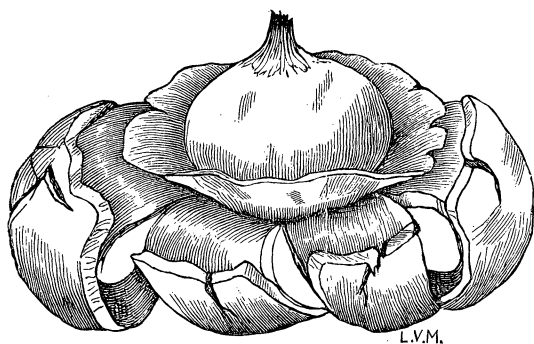


Fig. 2.

In this species the inner coat is not separated at the base or on the upper portion of the segments, but simply breaks away enough to form a cup about the inner peridium. Outer peridium 4-6 parted, the segments revolute; inner peridium pallid, globose or depressed, $\frac{3}{4}$ -1 $\frac{1}{2}$ inches in diameter; spores .0050-.0055^{mm}.

2. STRIATI.

Outer peridium single, multipartite, the segments revolute; inner peridium subsessile, the mouth sulcate-plicate.

4. *G. striatus* DC.—Inner peridium subpedicellate; the mouth prominent, conic, sulcate-striate (Fig. 3).

Segments of the outer peridium 7-9, nearly equal, acuminate; pedicel various, often very short. Inner peridium globose, smooth or at first punctulate, umber-brown, $\frac{1}{2}$ - $\frac{3}{4}$ of an inch in diameter; the mouth prominent, plicate; spores .0035-.0040^{mm}.

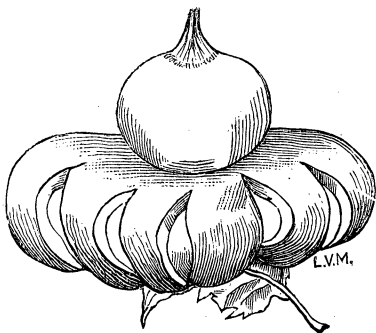


Fig. 3.

5. *G. umbilicatus* Fr.—Inner peridium sessile; the mouth plicate-striate, in a compressed marginate disk (Fig. 4).

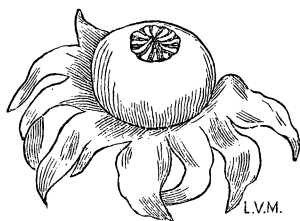


Fig. 4.

Segments of the outer peridium 7–10, unequal, sub lanceolate. Inner peridium globose or depressed globose, blackish umber, about $\frac{1}{2}$ an inch in diameter; the mouth conic, plicate-striate, in a circular depressed marginate umbilicus; spores .0035–.0040^{mm}.

3 LIMBATI.

Outer peridium single, expanded, multifid; inner peridium pedicellate.

6. *G. bryantii* Berk.—Inner peridium pedicellate, the pedicel with a circumscissile sheath; mouth conic, sulcate-plicate (Fig. 5).

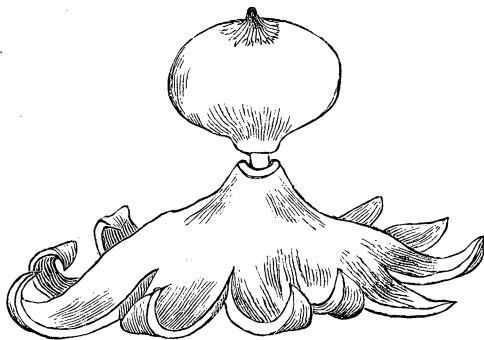


Fig. 5.

Outer peridium concave or vaulted underneath the base; segments 8–10, unequal, acute, inflexed at the apex; a tubular sheath surrounds the pedicel, which bursts as the plant expands, the upper part remaining as a ring about the summit of the pedicel. Inner peridium subglobose, brown, $\frac{3}{4}$ –1 inch in diameter, the mouth prominent, conic, plicate; spores .0040–.0045^{mm}.

7. *G. limbatus* Fr.—Inner peridium pedicellate, the pedicel solid; mouth depressed, subacute, fimbriate pilose (Fig. 6).

The outer peridium is concave or vaulted, and the segments inflexed as in *G. bryantii*, but there is no tubular sheath about the pedicel; the pedicel is short, a little thickened upward, passing into the inner peridium. Inner peridium subglobose, brownish,

often constricted above base so as to form a circular groove, $\frac{3}{4}$ –1 inch in diameter; spores .0040–.0045^{mm}.

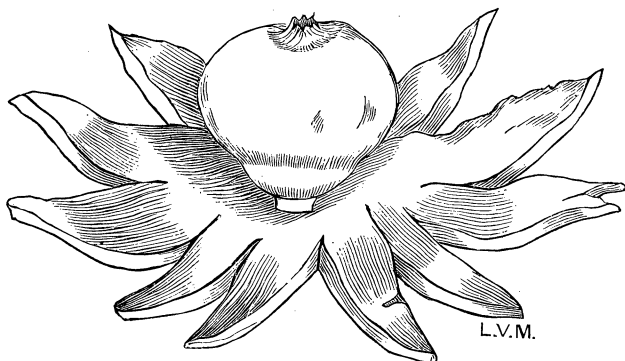


Fig. 6.

8. *G. minimus* Schw.—Inner peridium subpedicellate, white; the mouth plano-conic, ciliate (Fig. 7).

Outer peridium with a vaulted base, white beneath; the segments 7–9, “elegantly revolute,” brownish where they touch the soil, with an expanse of about $\frac{1}{2}$ an inch. Inner peridium ovoid with a plane base, glabrous, pure white, about $\frac{1}{4}$ of an inch in diameter; spores .0040–.0045^{mm}.

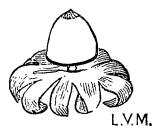


Fig. 7.

4. FIMBRIATI.

Outer peridium multifid, the segments revolute; inner peridium sessile, the mouth ciliate-fimbriate.

9. *G. fimbriatus* Fr.—Inner peridium globose or depressed globose; the mouth indeterminate, piloso-fimbriate (Fig. 8).

Segments of the outer peridium 6–8, equal, acute, flaccid, the superior stratum receding. Inner peridium wanting the paler circle in which the determinate mouth of other species is situated, $\frac{3}{4}$ –1 inch in diameter; spores .0030–.0035^{mm}.

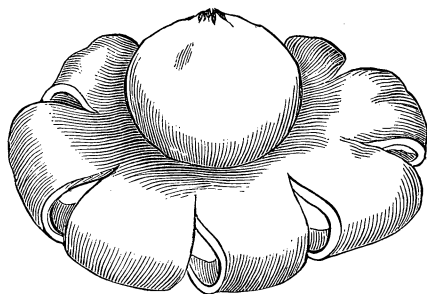


Fig. 8.

10. *G. vittatus* Kalch.—Lower surface of the segments longi-

tudinally rimose, so as to appear white-vittate; inner peridium globose or depressed globose, the mouth determinate.

Outer peridium vaulted at the base; the segments 6-9, regular, long acuminate, the inferior side subglabrous, alutaceous; the vittæ simple, linear, somewhat parallel, $\frac{1}{2}$ - $\frac{3}{4}$ of an inch in diameter; spores .0030-.0035^{mm}.

11. *G. saccatus* Fr.—Outer peridium saccate; inner peridium globose or depressed globose, the mouth determinate (Fig. 9).

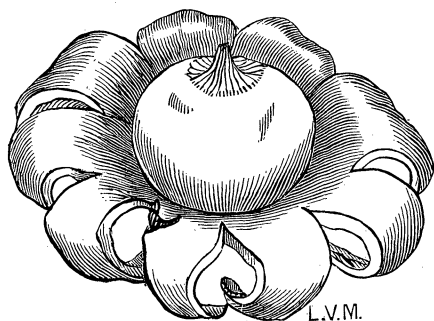


Fig. 9.

more or less erected or inflexed in dryness. Inner peridium pallid or brownish, $\frac{1}{2}$ - $\frac{3}{4}$ of an inch in diameter; spores .0030-.0035^{mm}.

12. *G. lagenæformis* Vitt.—Inner peridium ovoid, the mouth determinate; spores smooth (Fig. 10).

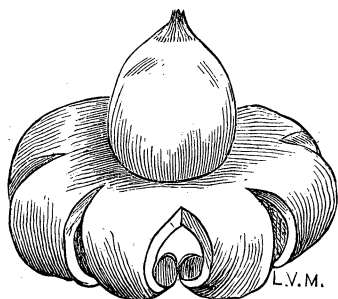


Fig. 10.

Segments of the outer peridium 6-9, nearly equal, ovate, acuminate, the inner stratum receding. Inner peridium pallid or brownish, $\frac{1}{2}$ an inch or less in diameter; spores .0030-.0035^{mm}.

5. DENTATI.

Outer peridium multifid, the segments revolute; inner peridium sessile, the mouth dentate.

13. *G. rufescens* Pers.—Inner peridium subovoid, the mouth determinate (Fig. 11).

Exterior peridium firm persistent, at first saccate, at length all resolute. Exceedingly variable in size; a rufous color prevails in the flesh of the segments and the inner peridium; spores .0040-.0045^{mm}.

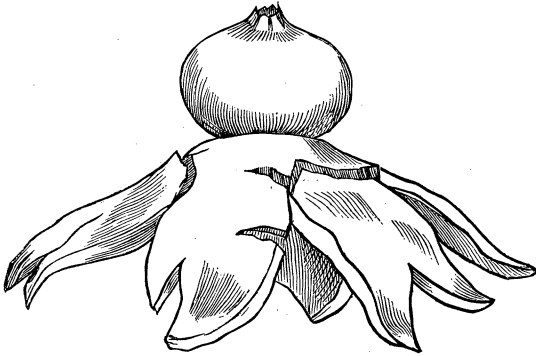


Fig. 11.

6. HYGROMETRICI.

Segments of the outer peridium becoming rigid and inflexed; inner peridium sessile, the mouth lacerate.

14. *G. hygrometricus* Pers.—Outer peridium multipartite, thick, glabrate; inner peridium subreticulate (Fig. 12).

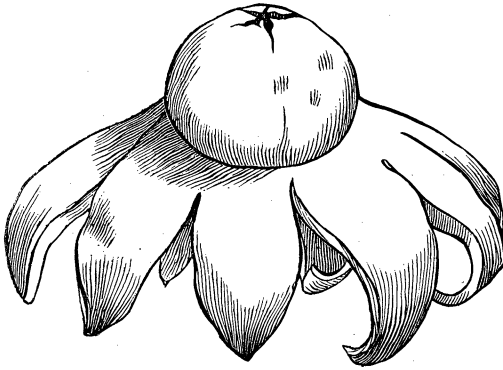


Fig. 12.

Outer peridium exceedingly thick and rigid; externally canescent, somewhat woody; lined inside by a stratum, thick, subdiscrete, brownish, waxy, cracked when dry. Inner peridium scurfy or reticulate, brown then canescent, $\frac{3}{4}$ –1 inch in diameter; spores large, .008–.010^{mm}.

15. *G. fibrillosus* Schw.—Outer peridium multipartite, externally fibrillose-scaly; inner peridium smooth.

Related to the preceding, but the segments more numerous, acuminate, externally often elegantly areolate, with fibrils, rufescent within. Inner peridium not reticulate, subglobose. It is said to be about two inches broad when expanded.

16. *G. linkii* Spreng.—Both the inner and outer peridia at first fleshy then rigid and multified.

Schweinitz found this species not rare in Pennsylvania; he declares it does not belong to the Geasters and gives it as *Actinodermium sternbeckii* Spf. He says it frequently grows cæspitously, 3–4 individuals connected by roots; the expanded segments sometimes attain a breadth of more than half a foot. It must be a remarkable fungus.

—:O:—

ON CATAGENESIS.¹

BY E. D. COPE.

I. THE EVOLUTION OF ORGANISMS.

THE general proposition that life has preceded organization in the order of time, may be regarded as established. It follows necessarily from the fact which has been derived from palæontological investigation, that the simple forms have, with few sporadic exceptions, preceded the complex in the order of appearance on the earth. The history of the lowest and simplest animals will never be known on account of their perishability; but it is a safe inference from what is known, that the earliest forms of life were the rhizopods, whose organization is not even cellular, and includes no organs whatever. Yet these creatures are alive, and authors familiar with them agree that they display, among their vital qualities, evidences of some degree of sensibility.

The following propositions were laid down by Lamarck, as established by facts known to him, in 1809:²

I. "In every animal which has not passed the term of its development, the frequent and sustained employment of an organ, gradually strengthening it, develops and enlarges it, and gives it power proportional to the duration of its use; whilst the constant disuse of a like organ insensibly weakens it, deteriorates it, progressively reduces its functions, and finally causes it to disappear.

II. "All that nature acquires or loses in individuals, through the influence of circumstances to which the race has been exposed

¹ An address delivered before the Biological Section of the American Association for the Advancement of Science, at Philadelphia, September 4th, 1884, by E. D. Cope, vice-president.

² Philosophie Zoologique, Pt. I, p. 235 (Edit. 1830).